

In the claims

Claims 2, 4, 5, 9, 10, 13, 18-24, 29, and 60-67 are amended herein to address the Examiner's objections as to informalities and improper form.

Claims 17, 51, and 68 are amended herein. Applicants note that Owen, US Pat. No. 5,081,391 teaches use of bender transducers (col. 2, lines 6-10) and piezoelectric cylindrical transducers.

This listing of claims will replace all prior versions and listings of claims in the application:

Claims

[c1] (Previously presented) A sleeve for the receiver section for an acoustic logging tool including a tool body with receiver stations; the sleeve being capable of surrounding the tool body at least in the region of the receiver stations and having first and second apertured portions spaced along its length, the first apertured portion having elongate axial bar elements separated by windows in a circumferential arrangement, the windows being wider than the bars, and the second apertured portion having rows of circumferentially elongate slots; characterised in that each slot has a center portion and end portions, the center portion being narrower than the end portions, and the end portions being enlarged compared to the center portion, wherein the dimensions in the first apertured portion are chosen to provide a low spring constant to the sleeve.

[c2] 2 (Currently amended) A sleeve as claimed in claim 1, wherein the slots of the second apertured portion have parallel sides in the centre portion and approximately circular end portions.

[c3] (Previously presented) A sleeve as claimed in claim 2, wherein the ratio of the width of the slot in the centre portion to the radius of the end portion is at least 1:4.

[c4] 4 (Currently amended) A sleeve as claimed in claim 3, wherein the ratio is about 1:6.

[c5] (Currently amended) A sleeve as claimed in claim 1 ~~or 2 or 3~~ wherein a second apertured portion is provided at each end of the sleeve.

[c6] (Previously presented) A sleeve as claimed in any of claims 1 to 5, wherein each first apertured portion has no more than eight windows.

[c7] (Previously presented) A sleeve as claimed in any of claims 1 to 6, wherein a first apertured portion surrounds the receiver stations.

[c8] (Previously presented) A sleeve as claimed in claim 7, wherein the windows of a first apertured portion are located in front of the receiver stations.

[c9] 9 (Currently amended) A sleeve as claimed in any of claims 1 to 8, when forming part of an acoustic logging tool having a tool body with a transmitter section and a receiver section.

[c10] (Currently amended) An acoustic logging tool comprising a tool body with a transmitter section and a receiver section comprising a number of receiver stations spaced along a tool body, each station comprising at least one receiver and a sleeve surrounding the tool body at least in the region of the receiver stations and having first and second apertured portions spaced along its length, the first apertured portion having elongate axial bar elements separated by windows in a circumferential arrangement, the windows being wider than the bars, and the second apertured portion having rows of circumferentially elongate slots, characterised in that the sleeve comprises a sleeve as claimed in ~~any of claims 1 to 9~~.

[c11] (Previously presented) A tool as claimed in claim 10, wherein the slots in each row of the second apertured portion are offset from adjacent rows.

[c12] (Previously presented) A tool as claimed in claim 10 or 11, wherein each station is surrounded by a first apertured portion of the sleeve.

[c13] (Currently amended) A tool as claimed in claim ~~10, 11 or~~ 12, comprising a central mandrel around which are mounted alternate, receiver mounts and spacers, the spacers being firmly connected to the mandrel and the receiver mounts being held in position by the spacers.

[c14] (Previously presented) A tool as claimed in claim 13 wherein the spacers and receiver mounts are made of steel.

[c15] (Previously presented) A tool as claimed in claim 13 or 14, wherein each receiver mount contacts its neighbouring spacers via resilient contact pads.

[c16] (Previously presented) A tool as claimed in any of claims 13, 14 or 15, wherein, when arranged vertically, the weight of each receiver mount is carried by the spacer located below that mount.

[c17] (Currently amended) A receiver section for an acoustic logging tool comprising a number of receiver stations spaced along a tool body, each station including a number of polarised pressure sensors configured in a stack wherein the axis of polarisation of the stack of sensors is parallel to the axis of the tool body.

[c18] ~~18~~ (Currently amended) A receiver section as claimed in claim 17, wherein the pressure sensors comprise piezoelectric stacks.

[c19] ~~19~~ (Currently amended) A receiver section as claimed in claim 17 or 18, wherein each station has four pressure sensors spaced equidistantly around the tool body.

[c20] ~~20~~ (Currently amended) A receiver section as claimed in claim ~~17, 18 or~~ 19, comprising a central mandrel around which are mounted alternate, pressure sensor mounts and spacers, the spacers being firmly connected to the mandrel and the sensor mounts being held in position by the spacers.

[c21] ~~21~~ (Currently amended) A receiver section as claimed in claim 20 wherein the spacers and pressure sensor mounts are made of steel.

[c22] ~~22~~ (Currently amended) A receiver section as claimed in claim 20 or 21, wherein each pressure sensor mount contacts its neighbouring spacers via resilient contact pads.

[c23] ~~23~~ (Currently amended) A receiver section as claimed in claim ~~20, 21 or~~ 22, wherein, when arranged vertically, the weight of each pressure sensor mount is carried by the spacer located below that mount.

[c24] ~~24~~(Currently amended) A receiver section as claimed in any of claims 17 to 23, when forming part of an acoustic logging tool having a sonde body which also includes a transmitter section.

[c25] (Previously presented) A receiver section as claimed in any of claims 17 to 24, further comprising a sleeve being capable of surrounding the tool body at least in the region of the receiver stations and having first apertured portion and second apertured portion spaced along its length, wherein

- (a) the first apertured portion has elongate axial bar elements separated by windows in a circumferential arrangement, the windows being wider than the bars, and
- (b) the second apertured portion has rows of circumferentially elongate slots, each slot having a center portion and end portions, the center portion being narrower than the end portions, and the end portions being enlarged compared to the center portion.

[c26] (Previously presented) A receiver section as claimed in claim 25, wherein the slots of the second apertured portion have parallel sides in the center portion and approximately circular end portions.

[c27] (Previously presented) A receiver section as claimed in claim 26, wherein the dimensions of the windows in the first apertured portion are chosen to give a low spring constant to the sleeve.

[c28] (Previously presented) A receiver section as claimed in claim 27, wherein first apertured portions and second aperture portions alternate along the length of the sleeve.

[c29] (Previously presented) A receiver section as claimed in claim 25, 26 or 27 wherein each second apertured portion is provided at each end of the sleeve..

[c30] (Previously presented) A receiver section as claimed in any of claims 25 to 29, wherein each first apertured portion has no more than eight windows.

[c31] (Previously presented) A receiver section as claimed in any of claims 25 to 30, wherein a first apertured portion surrounds the receiver stations.

[c32] (Previously presented) A receiver section as claimed in claim 31, wherein the windows of a first apertured portion are located in front of receiver stations.

Claims 33-50 (Previously cancelled).

[c51] (Currently amended) An acoustic logging tool comprising a tool body with a transmitter section and a receiver section, said receiver section comprising a number of receiver stations spaced along a tool body, each station including a number of polarized pressure sensors, comprising piezoelectric stacks, characterized in that the axis of polarization of the stack of sensors is parallel to the axis of the tool body.

[c52]. (Previously presented) An acoustic logging tool comprising a tool body with a transmitter section comprising a dipole transmitter and a receiver section comprising a number of receiver stations spaced along a tool body, each station including a number of polarized pressure sensors spaced around the circumference of the tool body, characterized in that the axis of polarization of the sensors is parallel to the axis of the tool body.

[c53]. (Previously presented) The acoustic logging tool of claim 52, wherein the pressure sensors comprise ceramic piezoelectric stacks.

[c54]. (Previously presented) The acoustic logging tool of claim 52, wherein each said station comprises four pressure sensors spaced equidistantly around the tool body.

[c55]. (Previously presented) The acoustic logging tool of claim 52, wherein the receiver section further comprises a central mandrel around which are mounted alternate, pressure sensor mounts and spacers, the spacers being firmly connected to the mandrel and the sensor mounts being held in position by the spacers.

[c56]. (Previously presented) The acoustic logging tool of claim 55 wherein said spacers and said pressure sensor mounts are made of steel.

[c57]. (Previously presented) The acoustic logging tool of claim 55 wherein each pressure sensor mount contacts its neighboring spacers via resilient contact pads.

[c58]. (Previously presented) The acoustic logging tool of claim 55, wherein, the central mandrel comprises a rod having a sheath.

[c59]. (Previously presented) The acoustic logging tool of claim 52, wherein said receiver section forms a part of an acoustic logging tool comprising a sonde body and a transmitter section.

[c60] ~~60.~~(Currently amended) A receiver section for an acoustic logging tool comprising a number of receiver stations spaced along a tool body, each station including a number of polarized pressure sensors spaced around the circumference of the tool body, characterized in that the axis of polarization of the sensors is parallel to the axis of the tool body, wherein said section further comprises a sleeve capable of surrounding the tool body at least in the region of the receiver stations and having an alternating first and second apertured portions spaced along its length, wherein

- (a) the first apertured portion has elongate axial bar elements separated by windows in a circumferential arrangement, the windows being wider than the bars, and
- (b) the second apertured portion has rows of circumferentially elongate slots, each slot having a center portion and end portions, the center portion being narrower than the end portions, and the end portions being enlarged compared to the center portion.

[c61] ~~61.~~ (Currently amended) The receiver section of claim 60, wherein the slots of the second apertured portion have parallel sides in the center portion and approximately circular end portions.

[c62] ~~62.~~(Currently amended) The receiver section of claim 61, wherein the ratio of the width of the slot in the center portion to the radius of the end portion is at least 1:4.

[c63] ~~63.~~(Currently amended) The receiver section of claim 62, wherein the ratio is about 1:6.

[c64] ~~64.~~(Currently amended) The receiver section of claim 60 wherein each second apertured portion has three rows of slots.

[c65] ~~65.~~(Currently amended) The receiver section of claim 60 wherein the first apertured portion has windows of two alternating widths.

[c66] ~~66.~~ (Currently amended) The receiver section of claim 64, wherein the windows have widths of 25° and 45° respectively.

[c67] 67. (Currently amended) A receiver section for an acoustic logging tool comprising a number of receiver stations spaced along a tool body, each station including a number of polarized pressure sensors spaced around the circumference of the tool body, characterized in that the axis of polarization of the sensors is parallel to the axis of the tool body, wherein said section further comprises a sleeve capable of surrounding the tool body at least in the region of the receiver stations and having an alternating first and second apertured portions spaced along its length, wherein

(a) the first apertured portion has elongate axial bar elements separated by windows in a circumferential arrangement, the windows being wider than the bars, wherein said windows are of a plurality of alternating widths, and

(b) the second apertured portion has a plurality of rows of circumferentially elongate slots, each slot having a center portion and end portions, the center portion being narrower than the end portions, and the end portions being enlarged compared to the center portion, wherein the ratio of the width of the slot in the center portion to the radius of the end portion is at least 1:4.

68. (Currently amended) A receiver section for an acoustic logging tool comprising a number of receiver stations spaced along a tool body, each station including a number of polarized pressure sensors configured in a stack spaced around the circumference of the tool body, characterized in that the axis of polarization of the stack of sensors is parallel to the axis of the tool body, said pressure sensors in pressure sensor mounts disposed about a central mandrel, wherein said pressure mounts are moveable along the mandrel.

69. (Previously presented) The receiver section of claim 68, further comprising spacers between the pressure sensor mounts, wherein spacers are firmly connected to said central mandrel.

70. (Previously presented) The receiver section of claim 69, wherein the pressure sensor mounts and the spacers are made of steel.

71. (Previously presented) The receiver section of claim 69, further comprising compliant pads between the pressure sensor mounts and the spacers.